



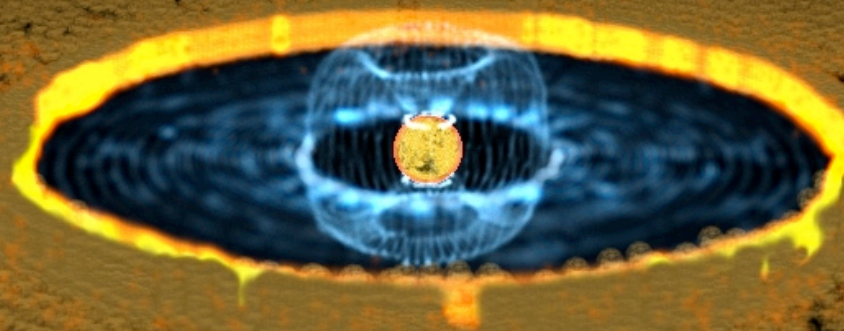
National Aeronautics and
Space Administration
Jet Propulsion Laboratory
California Institute of Technology



MSC Michelson Science Center

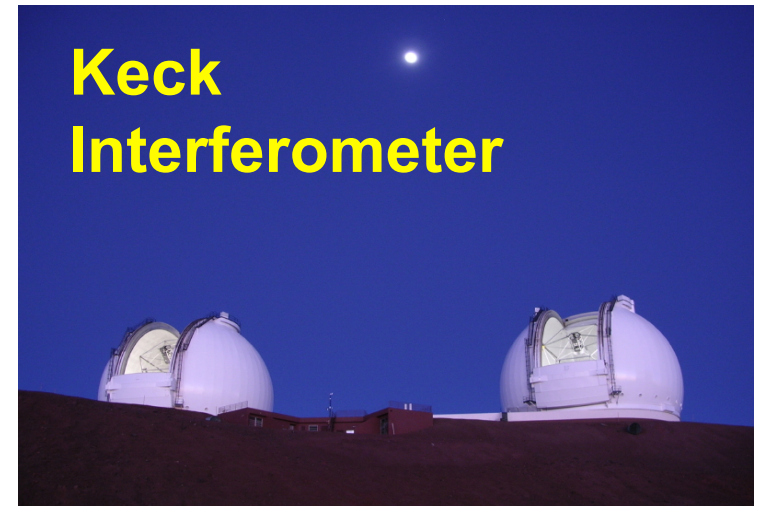
The Inner AU of Circumstellar Disks

Rafael Millan-Gabet
Caltech / Michelson Science Center
And Collaborators



JPL Exo-Planet Science & Technology Fair Feb 22 2008

Why Optical Interferometry of Young Disks?



- **Spatial Resolution:**

- $\lambda/2B = 4\text{mas}$ for $B=100\text{m}$ $\lambda=2.2\mu\text{m}$ or 0.4 AU @ 100pc
- $\lambda/2B = 21\text{mas}$ for $B=100\text{m}$ $\lambda=10\mu\text{m}$ or 2 AU @ 100pc
- These measurements place very powerful constraints on the **spatial distribution** of material:
 - Break the degeneracies inherent to SED modeling alone.
- Help establish the morphology and physical conditions of the dust & gas, from near the star to few AU:
 - **initial conditions for terrestrial planet formation**

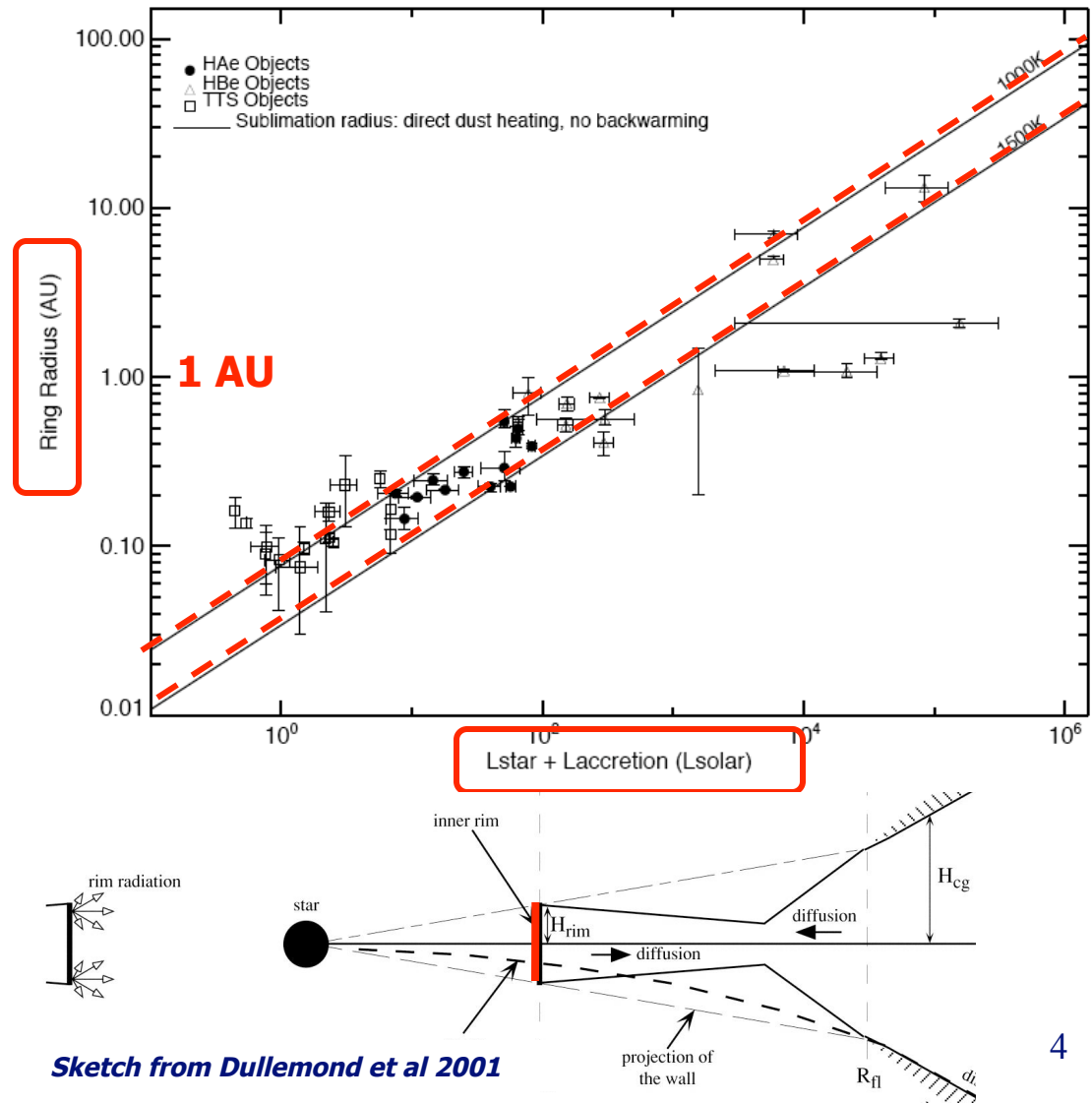
Some things you can find in my poster ...

See also R. Akeson poster ...

1. Measuring Near-IR Disk Sizes and motivating/testing new models for the inner disk

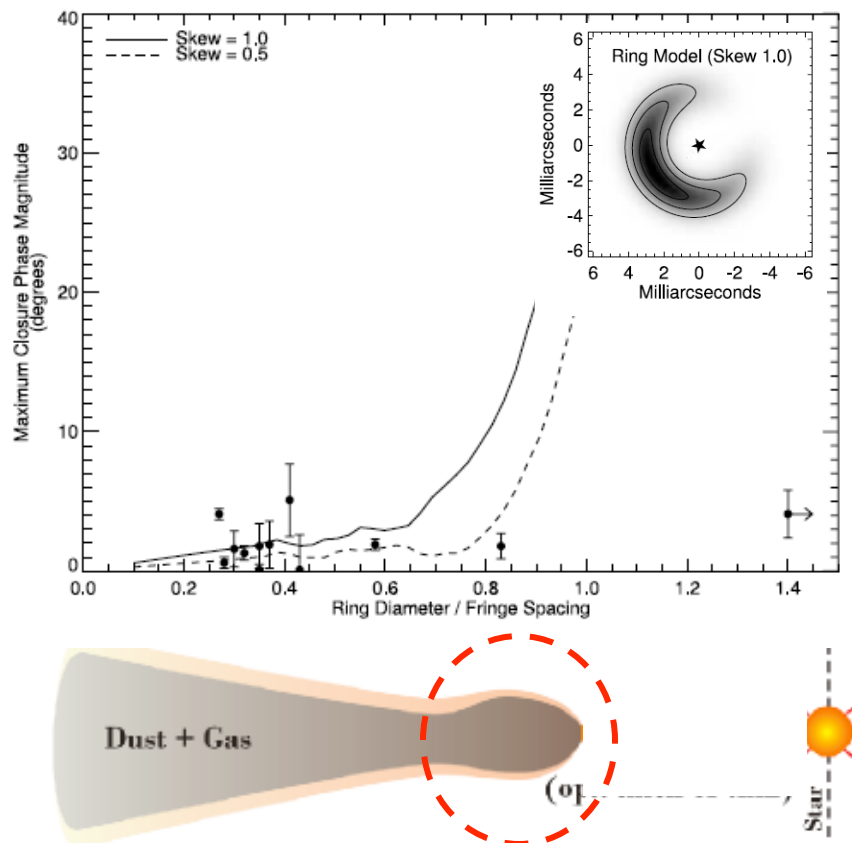
- The NIR disk sizes measured largely follow the inner dust sublimation radii; these results played a crucial role in motivating a new class of models for the inner dust rim.
- Remaining scatter in the Lstar - NIR Size relation is being actively investigated, by adding additional physical processes (scattering, thermal gas emission...)

See the review by Millan-Gabet, Malbet, Akeson et al. 2007 in *Protostars & Planets V*



2. Probing higher order morphology using Closure Phases

The low CPs measured at IOTA indicate a surprisingly high degree of centro-symmetry, favoring very rounded inner dust rims...



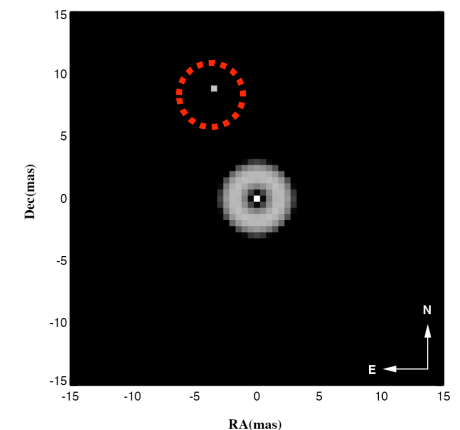
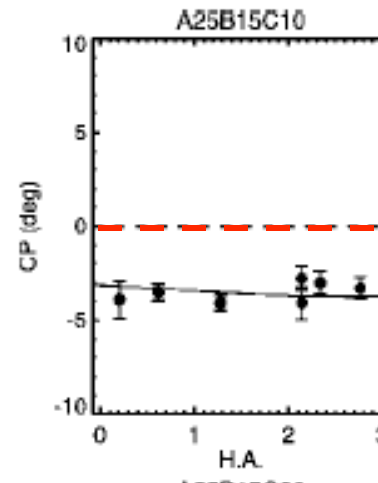
IOTA,
Mt Hopkins, AZ



Monnier, Millan-Gabet, Traub et al, ApJ, 2005

Millan-Gabet, Monnier, Traub et al. ApJ, 2006

The surprising case of AB Aur
A forming proto-planet??

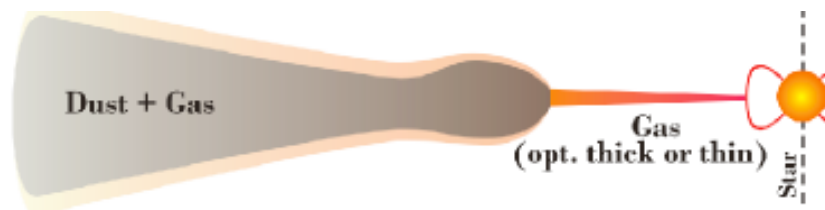


3. Probing higher order morphology with really long baselines

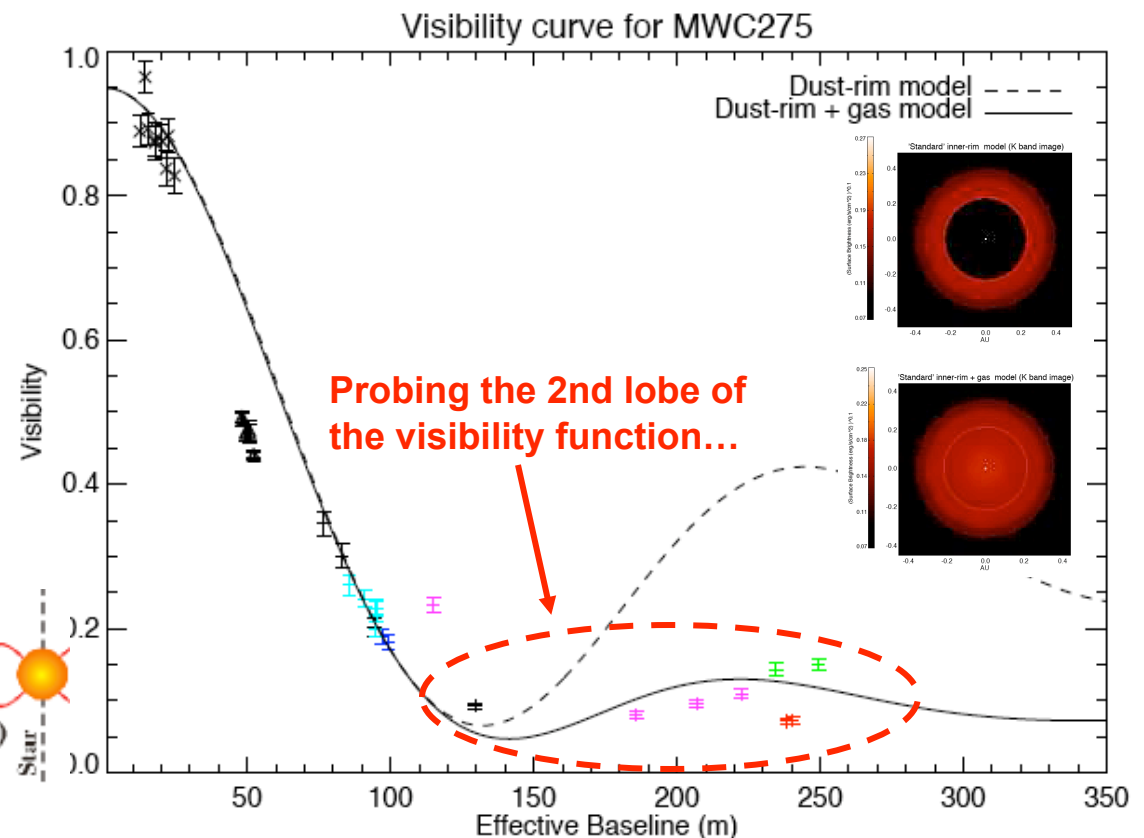
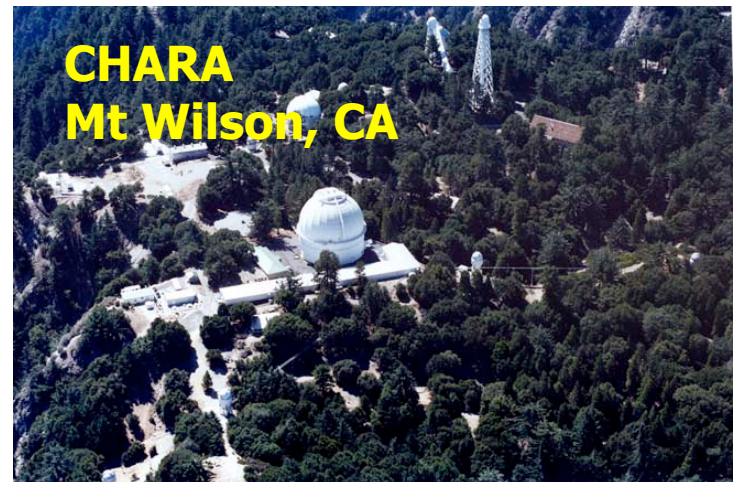
Tannirkulam, Monnier, Millan-Gabet et al. accepted, ApJ, 2008

- The very low visibilities measured by the CHARA longest baselines (~300m) cannot be reproduced by detailed models of inner dust rim (they cannot be made smooth enough).

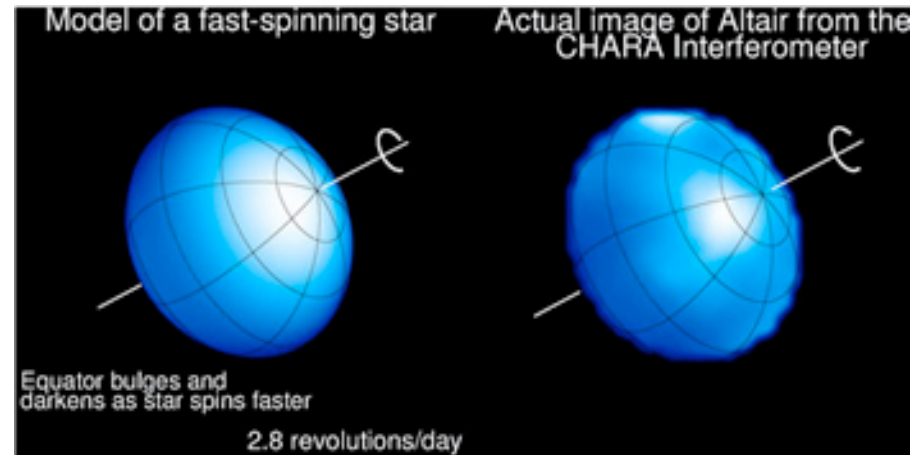
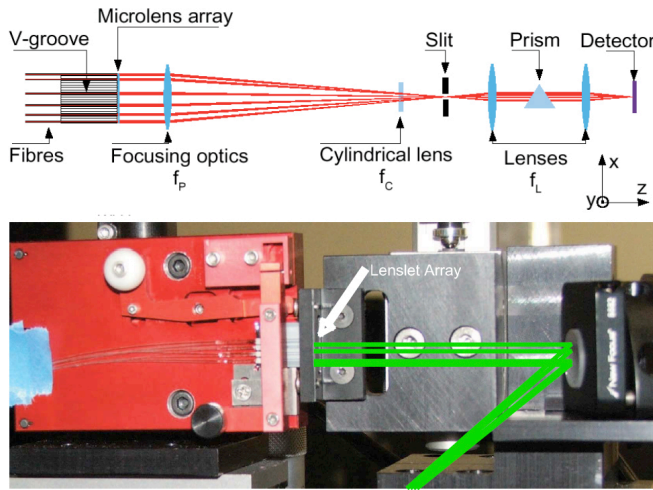
- Best explained by adding NIR emitting gas inside the dust sublimation radius.



Sketch from Kraus07



Exciting Prospect: Inner Disk Imaging with MIRC + CHAMP at CHARA



- Imaging combiner for the 6 CHARA telescopes & Higher sensitivity with fringe tracker CHAMP (PI: J. D. Monnier, U. Michigan).
- Obtained the first image of the surface of a main sequence star, Altair (Monnier et al. Science 2007)

Looking forward to making such images of the inner disks!

(Hot Jupiter direct detection via closure phases also possible - even w.o. CHAMP)